

Dinamika Populasi Mikrobia dan Aktivasnya pada Degradasi Substrat dan Produksi Metabolit Primer di Dalam Pulp Selama Fermentasi Kakao (*Theobroma cacao* L.) dengan Penambahan Ragi Tape

INTISARI

Fermentasi biji kakao pada dasarnya merupakan proses penguraian pulp biji kakao yang dilakukan oleh mikrobia. Ragi tape merupakan sumber mikrobia (starter) yang banyak digunakan untuk fermentasi yang mudah didapatkan dan disimpan. Penelitian ini bertujuan untuk mempelajari pola perubahan jumlah mikrobia dan aktivasnya terhadap degradasi substrat dan produksi metabolit primer di dalam pulp selama proses fermentasi biji kakao dengan penambahan ragi tape untuk mempercepat proses fermentasi.

Dalam penelitian ini, fermentasi dilakukan dalam skala lab sebanyak 2 kg dalam kotak plastik perbatch. Kotak fermentasi ditempatkan di dalam inkubator yang diatur suhunya perhari mengikuti perubahan suhu yang biasa terjadi pada fermentasi skala besar. Selama fermentasi, suhu fermentasi dan pH pulp kakao diamati termasuk enumerasi jumlah mikrobia, analisa degradasi substrat, produksi metabolit primer, pH biji fermentasi dan indeks fermentasi. Degradasi substrat dan metabolit primer dianalisa menggunakan *High Performance Liquid Chromatography* (HPLC) untuk analisa gula dan asam organik dan *Gas Chromatography* (GC) untuk analisa ethanol.

Hasil penelitian menunjukkan bahwa fermentasi biji kakao dengan penambahan ragi tape menghasilkan jumlah *yeast*, bakteri asam laktat (BAL) dan bakteri asam asetat (BAA) maksimal masing-masing sebesar $9,03 \pm 0,85$; $9,05 \pm 0,17$; dan $9,15 \pm 0,89$ log cfu/g pulp kakao dengan degradasi substrat berupa sukrosa berkurang 97%, glukosa 98,6%, fruktosa 97% dan asam sitrat 71% pada hari ketiga. Produksi maksimal metabolit primer ethanol sebesar $27,84 \pm 21,85$ mg/g pulp kakao, asam laktat $4,18 \pm 3,16$ mg/g pulp kakao dan asam asetat $3,38 \pm 5,43$ mg/g pulp kakao. Uji indeks fermentasi menunjukkan fermentasi biji kakao pada hari ketiga fermentasi sudah mencapai nilai $1,05 \pm 0,06$ dengan pH biji $5,97 \pm 0,20$. Karena itu, fermentasi biji kakao dengan penambahan ragi tape mampu mempercepat proses fermentasi menjadi tiga hari.

Kata kunci: fermentasi, pulp kakao, ragi tape, *yeast*, BAL, BAA, substrat, metabolit primer

Dynamics of Microbial Populations and Their Activity on Substrate Degradation and Primary Metabolites Production in Pulp during Cocoa Bean (*Theobroma cacao L.*) Fermentation with *Ragi Tape* Addition

ABSTRACT

Cocoa bean fermentation is basically the process of cocoa bean pulp decomposition carried out by microbes. *Ragi tape*, one of source of microbes (starter), is widely used for fermentation and easily obtained and stored. This study aims to study the dynamic of microbial population and their activity on substrate degradation and primary metabolites production in pulp during the cocoa bean fermentation with *ragi tape* addition.

In this study, a lab-scale cocoa bean fermentation was performed in a plastic box with a size of 2 kg cocoa bean. The fermentation plastic box was placed in an incubator where temperature was regulated per day following the temperature changes that normally occurred in large-scale fermentation. During fermentation, the number of microbes was enumerated. Substrate degradation and primary metabolites production were analyzed using High Performance Liquid Chromatography (HPLC) for sugar and organic acids and Gas Chromatography (GC) for ethanol. Fermentation index and pH of beans were also determined.

The results showed that the cocoa bean fermentation with *ragi tape* addition produced maximum amount of yeast, lactic acid bacteria (LAB) and acetic acid bacteria (AAB) at 9.03 ± 0.85 ; 9.05 ± 0.17 ; and 9.15 ± 0.89 log cfu/g cocoa pulp, respectively, accompanied by substrate degradation which was indicated by 97%, 98.6%, 97%, and 71.1% reduction of sucrose, glucose, fructose, and citric acid after three days. The microbial production of ethanol, lactic acid, and acetic acid as primary metabolites, reached maximum amount at 27.84 ± 21.85 ; 4.18 ± 3.16 ; 3.38 ± 5.43 mg/g cocoa pulp. The cocoa bean fermentation was regarded as completed at the third day shown by fermentation index value of 1.05 ± 0.06 and pH of beans 5.97 ± 0.20 . In this study, cocoa bean fermentation can be accelerated by *ragi tape* addition comparing to conventional method.

Keywords: fermentation, cocoa pulp, *ragi tape*, yeast, LAB, AAB, substrate, primary metabolites